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187Re - 187Os Nuclear Geochronometry: Advancing Precambrian Chronostratigraphy

Goetz Roller

Kompassbau Dr. Goetz Roller, 24 Forstenrieder Allee, Munich 81476, Germany (info@kompassbau.de)

^{187}Re - ^{187}Os nuclear geochronometry is a newly developed dating method, which combines ideas of nuclear astrophysics with geochronology. For this, the concept of sudden nucleosynthesis [1-3] is used to calculate so-called nucleogeochronometric Rhenium-Osmium two-point-isochrone (TPI) ages, using the IVREA nuclear geochronometer as one data point in a two-point-isochrone diagram. This chronometer is one of five terrestrial nuclear geochronometers identified so far [4]. It is based upon the peculiar and enigmatic isotopic Re-Os signature (Re/Os = 0.951, ^{187}Os/^{188}Os = 0.23211 $\pm$ 0.00018) from an Al-Augite Websterite dike within the Balmuccia Peridotite (Northern Italy) [5]. Constrained by nuclear theory and astrophysical evidence, the IVREA isotopic Re-Os signature may be explained as produced in a rapid (r) neutron-capture process around 3000 Ma ago [4]. Here, a TPI age is calculated for each of 9 drill core samples from a 20 m stratigraphic column (drill core ABDP-9, Astrobiology Drilling Program of the NASA Astrobiology Institute) of the Archean Mount McRae shales in Western Australia, which belong to the Pilbara Craton. An isochrone age of 2501.1 $\pm$ 8.2 Ma (^{187}Os/^{188}Os$_i$ = 0.04 $\pm$ 0.06, 95% CL) has previously been published for these 9 samples [6], using the open access computer program Isoplot [7] for the calculations. Therefore, the same program and data are used to test whether the results obtained by means of the new method meet the peer-reviewed results. As can be shown, all TPI ages are indeed consistent with the previously reported isochrone age. The same is true for the initial ^{187}Os/^{188}Os$_i$ ratios, which are in line with the enigmatic, extremely subchondritic initial ratio of ^{187}Os/^{188}Os$_i$ = 0.04 $\pm$ 0.06, constrained by the isochrone. TPI ages range from 2485 $\pm$ 66 Ma (^{187}Os/^{188}Os$_i$ = 0.0322 $\pm$ 0.0036, 95% CL) to 2519 $\pm$ 41 Ma (^{187}Os/^{188}Os$_i$ = 0.0312 $\pm$ 0.0035, 95% CL), with a mean value of 2501 $\pm$ 8.9 Ma (^{187}Os/^{188}Os$_i$ = 0.03267 $\pm$ 0.00073, 68% CL, n = 9). This age is virtually the same as the previously reported isochrone age of 2501.1 $\pm$ 8.2 Ma [6]. However, as can be derived from the nucleogeochronometric TPI calculations, accuracy and precision of the initial ^{187}Os/^{188}Osratio are now significantly improved in comparison with the conventional isochrone approach. Since a TPI age can be calculated for a single drill core sample taken from the stratigraphic column, it may be concluded that ^{187}Re - ^{187}Os nuclear geochronometry is a powerful tool to significantly advance especially (but not only) Archean and Proterozoic chronostratigraphy even on a small scale.

[1] Burbidge *et al.* (1957), *Revs. Mod. Phys.* **29**, 547 – 650. [2] Cameron (1957), CRL-41, Atomic Energy of Canada Limited, Chalk River, Ontario. [3] Hoyle *et al.* (1960) *ApJ* **132**, 565 – 590. [4] Roller (2014), GSA Abstr. **46**, 6, 323. [5] Roller (1997), PhD Thesis, RKP N+T, Munich. [6] Anbar *et al*. (2007), *Science* **317**, 1903 – 1906. [7] Ludwig (2012), Isoplot/Ex. 3.75, Special Publication Nr. 5, BGC, Berkeley.